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Effect of using formative assessment techniques on students' grades

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Abstract

This paper presents some of the results of a broader research project on how formative assessment affects the development of specific and generic competences in teacher training subjects at higher education level. The paper describes and discusses the impact of participatory and non-participatory assessment techniques on the attainment of learning outcomes in four different subjects. The sample was comprised of students ($n=118$) on teacher training bachelor's degrees at the University of Vic – Central University of Catalonia. Data were gathered on the lecturers' activities in each subject and on the students' final grades. One-way analysis of variance (ANOVA) was performed to assess the effect of formative assessment on students' final grades for a subject. Statistical analysis shows that students who took subjects that were assessed by participatory techniques had a significantly ($p<0.001$) higher average final grade than those who had not been assessed in this way. The discussion of this paper is based on other researches which argue that the improvement of students' learning outcomes can arise from an improved learning process.

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1. Introduction

1.1. Formative assessment

In the past, assessment was not considered part of the learning process. It was a mechanism that established how much a student had learnt, without contributing to the process that students must follow to gain abilities, knowledge and competences (López-Pastor, 2009). However, in recent times, a trend has emerged in higher education to disassociate assessment from the concept of grading, and instead incorporate it into students' learning process (Brown, 2015).

According to López-Pastor (2009), formative assessment is integrated into the teaching/learning process, and involves continuously gathering information to generate feedback for the student. Feedback helps students to modify, make decisions about, and improve their learning process. However, formative assessment does not just have a direct effect on students. It also provides information for lecturers on the suitability of their strategies. Teaching strategies should be designed to encourage independent learning, that is, to ensure that students assume a degree of control over their learning, which fosters learner autonomy (Rué, 2009) and the development of skills such as learning-to-learn.

1.2. The research project

This paper presents part of a research project funded by the Programme of Improvement and Innovation in Teacher Training (MIF), promoted by the Catalan Agency for Management of University and Research Grants (AGAUR). The aim of the project was to study the effects of formative assessment on the development of students' generic and specific competences. The research was carried out at the University of Vic – Central University of Catalonia with a group of seven lecturers, and focused on the generic and specific competences of each subject in the bachelor's degrees Teacher in Primary Education and Teacher in Early Childhood Education (Ramírez, Pla, Arumí, & Señé, 2015).

Various aspects were examined in the research project. This paper focuses on those related to the impact of formative assessment techniques on students' final grade for a subject. Therefore, the specific objective of this paper is to *show the impact of the assessment techniques used in the subjects under study on students' grades, and discuss the effect of these techniques on teaching*.

One of the key processes in the research was to define what formative assessment is and what it entails. This was vital to ensure that the lecturers' teaching had the characteristics required of formative assessment, and for the subjects to be studied in accordance with the aims of the research and with the differences between them. This was achieved by using a *Planning table* to describe the formative assessment means, techniques and instruments that were used in each subject.

The project researchers were also the lecturers, so that this study can be classified as action research. The results presented here are interpreted from this perspective: not as the conclusion of the research, but as a starting point to improve the teaching practices of this group of lecturers.

2. Method

2.1. Sample

The sample was comprised of students from four subjects of the bachelor's degrees in Teacher in Primary Education and Teacher in Early Childhood Education at the University of Vic – Central University of Catalonia. The initial sample was composed of 143 students enrolled on the four subjects. The final sample was 118 ($n=118$) due to the fact that not all the students completed the subject. It means that they did not participate actively throughout the subject and formative assessment could not be applied appropriately, so they could not get a final mark. Of the 118 students who participated in the study, 88 were female (74.6%) and 30 were male (25.4%).

2.2. Materials and procedure

A *Planning table* was the tool used to record the formative assessment activities that were implemented in each subject, and to list each activity according to its impact on the learning-to-learn, communication, digital and specific skills that the research was designed to study (Fig. 1).

Means (Task/Evidence of learning)	Formative assessment technique	Learning-to-learn skill		Assessment instruments	Social dimension	Digital skills	Establishment of assessment indicators
		Communication skill	Specific skill				
1	P						
	A						
2	P						
	A						
3	P						
	A						
4	P						
	A						
5	P						
	A						
6	P						
	A						
7	P						
	A						
8	P						
	A						
9	P						
	A						
10	P						
	A						
TAKE INTO ACCOUNT: as this is formative assessment, it is assumed that each task/evidence of learning will be monitored before it is submitted, as monitoring is implicit in this kind of assessment. During monitoring, students will receive feedback so that they know how to improve. In all cases, it should be considered that students must be familiar with the assessment indicators before they undertake the task/evidence of learning (means).							
SHORT EXPLANATION OF THE FUNCTION OF EACH TASK (MEANS)							
1							
2							
3							

Fig. 1. *Implemented formative assessment strategies* (Arumí, Pla, Ramírez & Señé, 2015).

The concepts of the table are defined below (Hamodi, López,& López, 2015):

- **Means:** the task or evidence of learning produced by the student for assessment. There are three kinds of means: written, oral and practical.
- **Assessment techniques:** the strategies the lecturer uses to gather information about students' output (the means), such as self-assessment, peer assessment, democratic assessment and teacher assessment.
- **Assessment instruments:** the tools the lecturer and students use to express the information gathered in an organized way and carry out the assessment

In relation to these three concepts, and on the lecturers' agreement, it was considered that formative assessment should always include the provision of feedback on the medium (the learning task) for students. Feedback not only informs students about the results they have obtained, but also enables them to modify their learning process, make decisions about it, and thus have more opportunities to attain the assessed competences.

In this study, we describe differences found in students' marks for subjects that used *participatory assessment techniques* (PAT) that is, techniques in which the student was involved in the process, including self-assessment, peer assessment or democratic assessment, and marks for subjects that used *non-participatory assessment techniques* (NPAT), namely assessment of students by teachers.

Once the definition of formative assessment was agreed for teachers and the *Planning table* was defined; at the beginning of the subject the table was administrated to the teachers in order to describe which elements of the formative assessment were applied in every subject. Only the data concerning to the formative assessment

techniques that teacher used were collected for the interests of this research. Finally, at the end of the subject the grades of the students were collected. Both data were added to the project database.

2.3. Statistical analysis

To analyse the data obtained for the whole project, a database was created with IBM® SPSS® Statistics 21.0 software. One-way analysis of variance (ANOVA) was performed to assess the effect of formative assessment on learning outcomes (the students' marks). The analysis was carried out for each type of formative assessment. In this case, variance was not equal in the ANOVA. The learning outcome variable was tested for normality using Kolmogorov-Smirnov and Shapiro-Wilk, and the normality assumption was rejected ($p < 0.001$).

3. Results and discussion

This study wanted to show the impact of the assessment techniques used in the subjects under study on students' grades and the results obtained show differences in students' grades depending on the assessment techniques. Table 1 summarizes the one-way ANOVA in relation to the learning outcome. According to the p value associated with the F statistic ($p = 0.011$), the assumption of equality of means was rejected. This indicates that the learning outcome was not the same for students involved in formative assessment using participatory assessment techniques (self-assessment, peer assessment and democratic assessment) and students who were not assessed by these techniques (assessment of students by teachers).

Table 1. Summary of the one-way ANOVA in relation to the learning outcome

	Sum of squares	Gl	Root mean square	F	Sig.
Inter-groups	10.234	1	10.234	6.728	0.011
Intra-groups	176.438	116	1.521		
Total	186.672	117			

The following table shows the differences in marks between techniques.

Table 2. Description of one-way ANOVA in relation to the learning outcome, according to the implementation of formative assessment

	N	Aver.	Stand. Dev.	Typical error	Confidence interv. (95%)		Min.	Max.
					Lower limit	Upper limit		
PAT	87	7.3530	0.81126	0.08698	7.1801	7.5259	5.50	9
NPAT	31	6.6839	1.99864	0.35897	5.9508	7.4170	0.63	9.51
Total	118	7.1772	1.26313	0.11628	6.9469	7.4075	0.63	9.51

Although the highest mark for students involved in PAT was lower than the highest mark for students involved in NPAT, the average mark was higher for PAT than NPAT students. So then students who have been involved in

participative assessment techniques seem to achieve better results. Few researches have studied differences between assessments techniques which is one of the issues that this research tends to analyse. There are some evidence that peer review assessment improve the final marks and promote positive effects in the overall perception of learning on student achievement and attitudes (Mulder, Pearce, & Baik, 2014; Mulder, Baik, Naylor, & Pearce, 2013; Topping, 1998).

Even though it has not been possible to find similar studies, there are some evidences that can lead a discussion. Focusing on the effect of formative assessment on students' grades, the results obtained bear similarities to the results of larger scale studies. These studies show that formative assessment has a positive effect on the students' learning process which is reflected on the final marks (Fisher, Cavanagh, & Bowles 2011; Romero-Martín, Fraile-Aranda, López-Pastor, & Castejón-Oliva, 2014). Some questions have been raised from this study that cannot be answered, such as: do the better learning outcomes reflect a bias in students' perceptions? Is the variation in learning outcomes due to differences between the subjects, differences in the lecturer's requirements, or both? Consequently, future studies should focus on two specific areas. First, a similar situation should be studied using a control group that enables us to compare the results; second, we should look in greater depth at specific differences between the techniques and their impact on the development of students' competences in the different subjects.

From a teaching perspective, it may seem that the results discourage interest in promoting formative assessment. This basic analysis could lead lecturers to the belief that the use of participatory assessment techniques lead to better marks, without any evidence that these marks correlate with better learning. However, aside from the scientific debate on the data, from a teaching perspective we consider that the better learning outcomes are the result of a better learning process, rather than a potential bias in students' perceptions of this process. This statement could be supported by the following ideas emerged from the research:

1. There is no evidence of bias in students' criteria when they assess their activity. In fact, the few studies found on this topic indicate that students' criteria converge with those of lecturers (Boud, Lawson, & Thompson, 2013).
2. Formative assessment encourages students to study; it makes them more aware of their learning process in relation to what they know and what they still need to learn (Weurlander et al., 2012).
3. The use of participatory assessment techniques is part of a plan of activities that promote self-regulated learning. Therefore, these are techniques that increase interest and willingness to learn, enhance reasoning skills, refine meta-cognitive skills, and improve results (Clark, 2012; Romero-Martín et al., 2014).

Formative assessment provides cognitive tools that help students to manage their learning processes, as we have shown. The use of this type of assessment technique makes sense in a world that requires increasingly independent people, as it fosters lifelong learning skills that help people to regulate their own learning (Boud & Falchikov, 2007).

Finally, two considerations should be taken into account:

- The data do not enable researchers to determine the specific effect that each of the participatory assessment techniques (PAT) that were used in the subjects may have had on the results.
- There are no data to determine whether the lecturers' requirements in each of the subjects had an impact on the differences in learning outcome.

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